

## CLAIMS

What is claimed is:

1. A method for filtering encoded signals received over a first channel through an Mth channel carrying a first encoded signal through an Mth encoded signals that are received over two or more primary channels in a multichannel communication system comprising:

receiving the first through Mth encoded signals over two or more primary channels, the two or more primary channels adjacent at least one alien channel;

providing the first through Mth encoded signals to a matrix filter, the matrix filter configured with a transfer function that is the inverse of the two or more channels to thereby cancel at least a portion of unwanted coupling onto the two or more primary channels from the primary channels and to reverse the effects of the channel on the first through Mth encoded signals;

processing the first through Mth encoded signals within the matrix filter to generate a first through an Mth encoded matrix filtered signals;

storing at least one of the first through Mth encoded matrix filtered signals in a memory;

decoding the Mth encoded matrix filtered signal to generate Mth channel data;

processing the Mth channel data to isolate an error term associated with the Mth channel data;

filtering the error term to generate at least one noise cancellation signal;

retrieving from memory an encoded matrix filtered signal received over channel M-1;

combining the at least one noise cancellation signal with the encoded matrix filtered signal received over channel M-1, wherein combining the noise cancellation signal cancels unwanted noise on the encoded matrix filtered signal received over channel M-1; and

decoding the encoded matrix filtered signal received over channel M-1 after combining to generate M-1 channel data.

2. The method of Claim 1, wherein the decoding comprises decoding a block encoded signal and an entire block is received and decoded on channel M before initiating decoding channel M-1.
3. The method of Claim 1, wherein the matrix filter comprises a feed-forward matrix filter configured to cancel self FEXT and distortion caused by transmission through a channel.
4. The method of Claim 1, wherein the error term comprises the difference between an matrix filtered signal from the matrix filter for a particular channel and an output from a decoder for a particular channel.
5. The method of Claim 1, wherein the memory is configured to store incoming encoded matrix filtered signals until processing on previous channels allows for processing of symbols on subsequent channels.
6. The method of Claim 1, wherein the two or more channels comprises between six and fourteen channels and wherein filtering the noise term comprises providing the noise term to a filter that is tailored to generate a cancellation signal capable of canceling the noise term from each of the previous channels.
7. The method of Claim 1, wherein the two or more channels comprise six to fourteen channels configured to transmit data over six to fourteen twisted pair conductors.

8. A method for processing two or more primary signals that are encoded and received over a multi-channel communication system, the processing configured to cancel unwanted coupling onto the two or more primary signals from alien signals, the method comprising:
  - receiving the two or more signals, wherein each of the two or more signals comprise primary components and coupling components;
  - storing at least one of the two or more signals in a memory;
  - for a first signal of the two or more signals, decoding the first signal and generating an error term associated with the first signal;
  - filtering the error term to generate a cancellation signal;
  - retrieving from memory at least a portion the second signal that was stored during decoding of the first signal;
  - combining the cancellation signal with at least a portion of the second signal to remove at least a portion of the coupling component from the second signal; and
  - decoding the second signal.
9. The method of Claim 8, wherein the signals comprise encoded symbols.
10. The method of Claim 8, wherein the generating an error term comprises re-encoding the decoded signal and subtracting the re-encoded data from an encoded signal.
11. The method of Claim 8, further comprising storing the decoded first signal in memory until completed with decoding the second signal.
12. The method of Claim 8, wherein decoding generates data represented by an encoded signal.

13. The method of Claim 8, wherein the encoded comprises block encoded and the first signal is received over a first channel and the second signal is received over a second channel, and an entire block is received on the first channel and is decoded before initiating decoding of a block received on the second channel.

14. A system for filtering a first encoded signal through Mth subsequent encoded signals received and associated with a first channel through Mth subsequent channels, the system comprising:

a memory configured to store at least two incoming encoded signals prior to decoding;

a noise cancellation system associated with at least two channels configured to:  
generate and process a cancellation signal;

a junction configured to combine the cancellation signal with an encoded subsequent signal on a subsequent channel to cancel noise on at least one encoded signal on at least one subsequent channel; and

a decoder associated with at least one channel configured to decode an encoded signal after cancellation of noise by the junction.

15. The system of Claim 14, wherein a decoder is associated with each channel and decoders associated with channels other than a first channel to undergo processing retrieve encoded signals from the memory.

16. The system of Claim 14, further comprising a delay configured to delay an encoded signal to synchronize at least one encoded signal with a decoder output.

17. The system of Claim 14, wherein the noise cancellation system further comprises a filter configured to processing the error term to generate the cancellation signal.

18. The system of Claim 14, wherein an encoded signal comprises a signal encoded using a code selected from the group of codes consisting of trellis coded modulation, turbo coded modulation, convolutional code, and block product turbo code.
19. The system of Claim 14, further comprising a matrix filter configured to perform matrix filtering on the encoded signals prior to decoding or storage in memory.
20. The system of Claim 14, wherein the decoder is configured to provide a decoded signal to the noise cancellation system.
21. The system of Claim 14, wherein the noise cancellation system received error terms from each previously decoded channel.
22. A multiple input, multiple output system configured to process and decode a first encoded signal through Mth subsequent encoded signals received over a first channel through Mth subsequent channels, the system comprising:
  - a first channel decoder configured to receive and decode a first encoded signal received over a first channel to create a decoder output;
  - a junction associated with the first channel configured to calculate a first error term based on the decoder output and the first signal;
  - a first channel filter configured modify the first error term to generate a second channel cancellation signal;
  - a first junction associated with a second channel configured to combine the second channel cancellation signal with a second channel signal to create a noise cancelled second channel signal;
  - a second channel decoder configured to decode the noise cancelled second channel signal to create a second channel decoder output;
  - a second junction associated with a second channel configured to calculate a second error term based on the second channel decoder output and the second signal; and

a second channel filter configured to modify the first error term and the second error term to generate a third channel cancellation signal.

23. The system of Claim 22, further comprising subsequent channels, wherein each channel has a decoder, filter, and one or more junctions configured to cancel noise and decode signals on the subsequent channels.

24. The system of Claim 22, further comprising a memory associated with at least a second channel through Mth channel configured to store incoming second channel through Mth channel encoded signals.

25. The system of Claim 22, wherein the error term comprises a difference between a decoded output and an encoded signal.

26. The system of Claim 24, wherein the memory is further configured to store at least one error term.

27. The system of Claim 24, wherein the memory is further configured to store decoder output.

28. The system of Claim 22, further comprising at least one delay configured to synchronize timing of two or more signals.

29. A method for processing three or more primary signals that are encoded and received over a multi-channel communication system, the processing configured to cancel unwanted coupling onto the two more primary signals from alien signals, the method comprising:
  - receiving the three or more signals over three or more channels, wherein each of the three or more signals comprises primary components and coupling components;
  - storing at least one of the three or more signals in a memory;
  - for a first signal of the three or more signals, decoding the first signal and generating a cancellation signal;
  - retrieving from memory at least a portion the second signal that was stored during decoding of the first signal;
  - combining the cancellation signal with the second signal of the three or more signals to remove at least a portion of the coupling component from the second signal; and
  - decoding the second signal.
30. The method of Claim 29, further comprising:
  - processing the decoded first signal and the decoded second signal to generate a second cancellation signal;
  - retrieving from memory at least a portion of the third signal;
  - combining the second cancellation signal with the third signal; and
  - decoding the third signal.
31. The method of Claim 29, wherein the signals comprise encoded symbols.
32. The method of Claim 29, wherein generating the cancellation signal comprises re-encoding a signal related to the difference between the transmitted signal and the

received signal and subtracting this re-encoded signal from the second signal that is encoded.

33. The method of Claim 29, further comprising storing the decoded first signal in memory until completed with decoding of all signals.

34. The method of Claim 29, wherein the process of decoding signals, generating cancellation signal, and combining the cancellation signal with another signal occurs on each subsequent channel.

35. The method of Claim 29, wherein an encoded signal comprises a block encoded signal and an entire block is received on the first channel and decoded before initiating decoding of a block received on a subsequent channel.